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Statistics of Small-pox and Vaccination in
Australia and Other Countries.

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BY

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At the time of issuing Bulletin No. 18, the full details of Statistics of Small-pox and Vaccination were not available. They are consequently now issued as an appendix.

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14th August, 1913.

Commonwealth Statistician.

No. 47—STATISTICS OF SMALL-POX AND VACCINATION.

At the present time the following statistics relating to small-pox and vaccination may be of public interest:—

Table I. shews the recoveries and deaths in 1000 cases in Great Britain (vaccinated and unvaccinated persons in different ratios), the number of persons subject to identical risks being, however, unknown. It contains also the results for Japan.

From the aggregate of the cases occurring in the epidemics of the United Kingdom, shewn in Table I., it will be seen that the rates of recovery were as follows, viz:—

All Cases	(46,136) ..	Recoveries	84.62%	..	Deaths	15.38%
Vaccinated	(36,488) ..	„	90.28%	..	„	9.72%
Unvaccinated	(9,648) ..	„	63.20%	..	„	36.80%

That is, the death-rate among the unvaccinated was 3.786 times as great as the death-rate among the vaccinated. The frequency of attack was, however, much greater among the vaccinated, the figures being as follows:—

Vaccinated attacked	36,488	Deaths	3,545 = 9.72%
Unvaccinated attacked	9,648	„	3,550 = 36.80%
(Japan—Vaccinated attacked)*	79,806	„	23,126 = 28.98%

That is, the number of vaccinated persons attacked was 3.782 times as great as the unvaccinated attacked. The significance of this relatively large frequency of attack on vaccinated persons may possibly be due to a great preponderance of vaccinated persons in the community. No figures are available shewing these numbers, but to be able to say whether vaccination offers any degree of immunity requires that the number of persons vaccinated and unvaccinated, exposed to equal risk of infection, should be known.

Table II. shews the percentage of deaths of children under 10 years of age compared with the estimated percentage of children who had not been vaccinated in the ten years previous to the epidemic. The percentage of deaths decidedly increases with the percentage of children not accounted for by vaccination. See note immediately under table.

Table III. shews the attack rate of vaccinated and unvaccinated persons under and over 10 years of age. The attack rate was ascertained by comparing the total number of cases of small-pox which occurred in the epidemics under review, with the total number of inmates of the dwellings in which such cases occurred, inmates and cases being each divided into vaccinated and unvaccinated. The table shews that the attack rate for children under 10 was about 6.8 per cent. for vaccinated, and 50.9 per cent. for unvaccinated, i.e., $7\frac{1}{2}$ times as great. For persons over 10 the figures were about 28.1 per cent. and 52.4 per cent., that is, only about 1.8 times as great.

Table IV. shews the severity of the attacks on vaccinated and unvaccinated persons. In this table varioloid or mild and discrete cases are classified as "mild," and coherent or confluent as "severe." This table shews that with the vaccinated, about 83 per cent. of the cases were mild, and about 17 per cent. severe, and with the unvaccinated about 27 per cent. were mild and about 73 per cent. were severe. That is, mild cases were about 3.1 times as frequent with the vaccinated as with the unvaccinated, and severe cases were about 4.2 times as frequent with the unvaccinated as with the vaccinated.

Table V. shews the percentage of deaths in cases of small-pox classified according to the number of vaccination marks borne by each patient. The table indicates that mortality was found to be less with an increase of the number of vaccination scars.

Table VI. shews the number of cases, deaths, and death rate of persons under and over 10 years of age, classified according to the number of vaccination marks borne by each patient.

There is no complete statistical information available as to the number of deaths, or injuries attributable to vaccination itself, but it may be mentioned that in the classification drawn up by the eminent English statistician, Dr. Farr, and modified by his successor, Dr. Ogle (both medical men), provision was made for recording deaths arising from "cow-pox and other effects of vaccination," and Tables VIII. and IX. are given shewing the numbers of deaths which are to be credited *directly* to vaccination. These are from the Registrar-General of England's reports. The numbers, for obvious reasons, are too small, *since they include only cases directly referable to vaccination.*

* See Table VII., page 5.

TABLE I.
RECOVERIES AND DEATHS PER THOUSAND CASES OF SMALL-POX
IN UNITED KINGDOM AND JAPAN.

PLACE.		RECOV- ERIES.	DEATHS.	TOTAL.	A	B
1.—Six Towns (1887-96) Sheffield, Dewsbury, London, Warrington, Leicester, Gloucester (11,065 cases). Pop. 4,961,100. One case in 448 persons per annum.	Vaccinated ..	749	42	791	5.3	6.68
	Unvaccinated ..	135	74	209	35.4	
	Total ..	884	116	1,000	11.6	
2.—Sheffield (1887-8) (4,703 cases). Population, 310,350. One case in 66 persons per annum.	Vaccinated ..	840	43	883	4.9	10.12
	Unvaccinated ..	59	58	117	49.6	
	Total ..	899	101	1,000	10.1	
3.—Leicester (1892-3) (357 cases) .. Population, 180,170. One case in 505 persons per annum.	Vaccinated ..	552	6	558	1.1	10.91
	Unvaccinated ..	389	53	442	12.0	
	Total ..	941	59	1,000	5.9	
4.—Gloucester (1895-6) (1,979 cases) Population, 44,800. One case in 23 persons per annum.	Vaccinated ..	551	61	612	10.0	4.07
	Unvaccinated ..	230	158	388	40.7	
	Total ..	781	219	1,000	21.9	
5.—Homerton and Fulham Hospital (1873-85) (12,987 cases)	Vaccinated ..	718	87	805	10.8	4.04
	Unvaccinated ..	110	85	195	43.6	
	Total ..	828	172	1,000	17.2	
6.—Homerton and Fulham Hospital (1873-85), excluding 1,561 doubtful cases, of whom 440 died (11,426 cases).	Vaccinated ..	718	61	779	7.8	5.56
	Unvaccinated ..	125	96	221	43.4	
	Total ..	843	157	1,000	15.7	
7.—Glasgow (1892) (700 cases) .. Population, 668,400. One case in 955 persons per annum.	Vaccinated ..	889	30	919	3.3	13.85
	Unvaccinated ..	44	37	81	45.7	
	Total ..	933	67	1,000	6.7	
8.—Glasgow (1900-1) (1,765 cases) Population, 755,300. One case in 428 persons per annum.	Vaccinated ..	846	85	931	9.1	5.74
	Unvaccinated ..	33	36	69	52.2	
	Total ..	879	121	1,000	12.1	
9.—Islington (1901-2) (301 cases) ..	Vaccinated ..	688	96	784	12.2	3.80
	Unvaccinated ..	116	100	216	46.3	
	Total ..	804	196	1,000	19.6	
10.—Annual Report of the Metro- politan Asylums Board for 1901-2 (9,659 cases).	Vac. or doubtful	673	91	764	11.9	2.77
	Unvaccinated ..	158	78	236	35.0	
	Total ..	831	169	1,000	16.9	
11.—Annual Report of the Metro- politan Asylums Board for 1901-2 (9,659 cases).	Vaccinated ..	646	73	719	10.2	3.35
	Unvac. or dbtful	185	96	281	34.2	
	Total ..	831	169	1,000	16.9	
12.—London, 30th Nov., 1901. Ad- mitted to Metropolitan Asylum Board's Hospitals (330 cases).	Vaccinated ..	591	136	727	18.7	3.57
	Unvaccinated ..	91	182	273	66.7	
	Total ..	682	318	1,000	31.8	
13.—London to end 1901. Admitted to Metropolitan Asylum Board's Hospitals (954 cases).	Vaccinated ..	683	113	796	14.2	3.90
	Unvaccinated ..	101	103	204	55.4	
	Total ..	784	216	1,000	21.6	
14.—London, all cases 1901 (1,743 cases). Population, 4,556,500. One case in 2603 persons per annum.	Vaccinated ..	687	100	787	12.7	2.51
	Unvaccinated ..	145	68	213	31.9	
	Total ..	832	168	1,000	16.8	
15.—London, all cases 1902 (7,916 cases) Population, 4,559,400. One case in 576 persons per annum.	Vaccinated ..	670	89	759	11.7	2.84
	Unvaccinated ..	161	80	241	33.2	
	Total ..	831	169	1,000	16.9	
16.—Total cases above in 1, 5, 7, 8, 9, 10, 14, and 15 (46,136 cases).	Vaccinated ..	714	77	791	9.7	3.79
	Unvaccinated ..	132	77	209	36.8	
	Total ..	846	154	1,000	15.4	
17.—Japan (1896-1910) (79,806 cases). Population, 46,616,500. One case in 8762 persons per annum.	Vaccinated ..	710	290	1,000	29.0	—
	Unvaccinated ..	None*	None*	None*		

Column A.—Percentages of deaths in cases of vaccinated and in cases of unvaccinated persons.
Column B.—Percentage of deaths of unvaccinated persons divided by percentage of deaths of
vaccinated persons (*i.e.*, factor of advantage of vaccination). * Probably none.

STATISTICS OF SMALL-POX EPIDEMICS IN ENGLISH TOWNS.*

TABLE II.

Towns.	Date of Epidemic.	Estimated Mean Percentage of Children Unaccounted for as to Vaccination for Date 10 years earlier than Epidemic.	Total Small-pox Deaths.	Percentage of Deaths under 10 Years of Age to Total Deaths from Small-pox.
Warrington	1892-93	4.8%	62	22.5%
Sheffield	1887-88	4.5%	589	26.9%
London	1892-93	9.9%	182	36.8%
Dewsbury	1891-92	32.3%	110	51.8%
Gloucester	1895-96	67.6%	434	64.5%
Leicester	1892-93	68.1%	21	71.4%

The results in Table II. can approximately be expressed as follows :—The percentage of deaths from small-pox of children under 10 years of age, to the total deaths from small-pox, is about 16.2 times the cube root of the percentage of children unaccounted for as to vaccination for a date 10 years earlier than the date of the epidemic, and the form of the curve *suggests* that if no children remained unvaccinated the number of deaths from small-pox would be very small. Japanese experience (Table VII. hereinafter) modifies, however, this view, inasmuch as it shews that epidemics occur in spite of compulsory and repeated vaccination. The numbers on which the percentages are based are so small, however, that any deductions are precarious.

TABLE III.

Towns.	Date of Epidemic.	Attack Rate of Children under 10 Years of Age.		Attack Rate of Persons over 10 Years of Age.	
		Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.
Sheffield	1887-88	7.9%	67.6%	28.3%	53.6%
Warrington	1892-93	4.4%	54.5%	29.9%	57.6%
Dewsbury	1891-92	10.2%	50.8%	27.7%	53.4%
Leicester	1892-93	2.5%	35.3%	22.2%	47.6%
Gloucester	1895-96	8.8%	46.3%	32.2%	50.0%
Arithmetic Mean ..	..	6.8%	50.0%	28.1%	52.4%

The numbers on which the percentages are based are so small, however, that any deductions are precarious.

TABLE IV.

Towns.	Mild.		Severe.	
	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.
London	89.0%	35.2%	11.0%	64.8%
Sheffield	82.8%	18.5%	17.2%	81.5%
Dewsbury	82.0%	23.1%	18.0%	76.9%
Leicester	81.4%	27.2%	18.6%	72.8%
Warrington	78.2%	29.4%	21.8%	70.6%
Arithmetic Mean ..	82.7%	26.7%	17.3%	73.3%

The numbers on which the percentages are based are so small, however, that any deductions are precarious.

* See comment, page 2.

TABLE V.*

Proportional Mortality of Cases of Small-pox treated in the Highgate Small-pox Hospital in 1836-51 and 1852-67, among Patients bearing one or more Vaccination Marks.

Cases of Small-pox classified according to the Vaccination Marks borne by each Patient.	Percentage of Deaths.	
	1836-51.	1852-67.
Unvaccinated	35.5%	34.9%
Stated to have been Vaccinated but having no cicatrix	21.7%	39.4%
Having one vaccine cicatrix	7.6%	13.8%
" two vaccine cicatrices	4.3%	7.7%
" three	1.8%	3.0%
" four or more vaccine cicatrices	0.7%	0.9%

TABLE VI.*

Deaths from Small-pox in the Fulham Hospital of Persons under and over 10 years of age, with the Proportional Case Mortality among Patients with one or more Vaccination Marks.

Age.	One Mark.			Two Marks.			Three Marks			Four or more Marks.		
	Cases.	Deaths	Death Rate.	Cases.	Deaths	Death Rate.	Cases.	Deaths	Death Rate.	Cases.	Deaths	Death Rate.
0-10	21	1	4.76%	29	1	3.45%	37	..	..	53	..	..
Over 10	384	41	10.68	509	46	9.04	459	37	8.06%	396	19	4.80%
All ages	405	42	10.37	538	47	8.73	496	37	7.45%	449	19	4.23%

* See comment, page 2.

That *small-pox may become epidemic* not only when vaccination is restricted but also *in spite of vaccination*, revaccination, and further "extraordinary" vaccination is shewn by comparing the statistics of England and Wales and Japan in Tables VIII. and IX. and VII. Compulsory vaccination was instituted in Japan in 1876, and was rigorously enforced throughout the country under Imperial Ordinance No. 34, issued in November, 1885. This requires vaccination every five to seven years. The last ordinance was repealed by that of the 14th April, 1909, which requires that every child shall be *vaccinated* before the June of the year following its birth; if this vaccination be unsuccessful then it must be vaccinated before the following June. *Second vaccination* is required in the tenth year after birth; if unsuccessful, vaccination must be effected before December of the following year. These provisions are said to be rigorously enforced. The following table shews that Japan is still subject to well-marked small-pox epidemics. The table shews the varying percentage of deaths in (presumably) vaccinated persons, the range being from about 2 per cent. to 41½ per cent., and averaging 30 per cent.

TABLE VII.
OCCURRENCES OF SMALL-POX IN JAPAN.†

Year.	No. of Cases.	No. of Deaths.	Percent- age of Deaths.	Year.	No. of Cases.	No. of Deaths.	Percent- age of Deaths.
1896	10,704	3,388	31.65	1904	1,227	237	19.32
7	42,347	12,316	29.08	5	301	62	20.60
8	2,034	395	19.42	6	519	109	21.00
9	1,613	250	15.50	7	1,053	437	41.50
1900	527	10	1.90	8	18,076	5,837	32.29
1	508	10	1.97	9	134	28	20.90
2	307	18	5.86	1910	1,991	13	0.65
3	357	16	4.48				

† Figures taken from the Statistical Summaries of Japan.
Total Cases, 79,806; Total Deaths, 23,126; Percentage of Deaths = 28.98%
Total Cases = 1 in 8,762 of the Population; Deaths = 1 in 30,236 of the Population.

TABLE VIII.

DEATHS DUE TO SMALL-POX, CHICKEN-POX AND THE EFFECTS OF VACCINATION IN ENGLAND AND WALES.

Year.	Small-pox.				Chicken- * pox.	Cowpox and other Effects of Vaccin- ation.
	Vaccin- ated.	Unvaccin- ated.	Not Known.	Total.		
1876	..	..	..	2,408	109	21
7	..	..	..	4,278	110	32
8	..	..	..	1,856	106	39
9	..	..	..	536	89	36
1880	..	..	..	648	103	41
1	652	1,068	1,378	3,098	133	58
2	176	325	816	1,317	122	65
3	78	162	717	957	99	55
4	493	595	1,146	2,234	129	53
5	580	795	1,452	2,827	109	52
6	25	43	207	275	93	45
7	42	111	353	506	87	45
8	91	269	666	1,026	116	45
9	4	2	17	23	83	58
1890	4	..	12	16	95	43
1	3	17	29	49	91	43
2	55	106	270	431	123	58
3	150	253	1,054	1,457	127	59
4	153	176	491	820	108	50
5	33	61	129	223	86	56
6	45	118	378	541	151	42
7	6	5	14	25	103	36
8	107	59	87	253	116	26
9	4	5	165	174	124	34
1900	7	17	61	85	127	25
1	141	111	104	356	115	17
2	821	791	852	2,464	123	22
3	123	174	463	760	116	26
4	75	124	308	507	104	28
5	23	20	73	116	93	26
6	..	1	20	21	106	29
7	2	2	6	10	120	12
8	..	..	12	12	93	13
9	5	6	10	21	94	11
1910	3	2	14	19	97	8
Total ..	5,741*	7,973*	16,635*	30,349	3,800	1,309
Proportion Vaccinated	18.92%	26.27%	54.81%	100%	..	..

* For the years 1876-80 the proportion of vaccinated and unvaccinated were estimated on the figures for the years 1881-1910.

In the period 1894-1906 inclusive, there were 12,057,507 births, and of these 8,438,459 were vaccinated as children, *i.e.*, 70%. The percentages for successive years were as follow :—

1894.	5	6	7	8	9	1900.	1	2	3	4	5	6
70.7	67.7	65.9	62.8	61.0	66.5	68.7	71.4	74.8	75.3	75.3	75.8	73.4

TABLE IX.

DEATHS DUE TO SMALL-POX, CHICKEN-POX AND THE EFFECTS OF
VACCINATION IN ENGLAND AND WALES.

Number of Deaths per One Million Persons. *

(See also Table XIII. hereinafter).

Year.	Small-pox, per 1,000,000 Persons of the Population.				Chicken- pox, per 1,000,000 Persons.	Cowpox and other Effects of Vaccin- ation, per 1,000,000 Vaccin- ated.
	Vaccin- ated.	Unvaccin- ated.	Not Known.	Total.		
1876	..	..	..	99	4	..
7	..	..	..	173	4	..
8	..	..	..	74	4	..
9	..	..	..	21	4	..
1880	..	..	..	25	4	..
1	25	41	53	119	5	..
2	7	12	31	50	5	..
3	3	6	27	36	4	..
4	18	22	42	82	5	..
5	21	29	53	103	4	..
6	1	2	8	11	3	..
7	2	4	13	19	3	..
8	3	10	24	37	4	..
9	*	*	1	1	3	..
1890	*	..	*	*	3	..
1	*	1	1	2	3	..
2	2	4	9	15	4	..
3	5	9	35	49	4	..
4	5	6	16	27	4	79
5	1	2	4	7	3	90
6	1	4	12	17	5	70
7	*	*	*	*	3	62
8	3	2	3	8	4	46
9	*	*	5	5	4	55
1900	*	1	2	3	4	39
1	4	3	3	10	4	26
2	25	24	26	75	4	31
3	4	5	14	23	3	36
4	2	4	9	15	3	39
5	1	1	2	4	3	37
6	..	*	1	1	3	42
7	*	*	*	*	3	..
8	..	..	*	*	3	..
9	*	*	*	*	3	..
1910	*	*	*	*	3	..
Average†	5.5	7.6	15.9	29.0	3.6	49.4‡

* In these years the number of deaths was not sufficient to produce a death-rate of more than 0.5, so the figures have been omitted.

† The average is based upon the totals of Table VIII. and the populations 1876-1910, the sole exception being final figure 49.4.

‡ Based upon the number vaccinated and number dying directly from that cause, 1894-1906.

It will be seen from this table that death as a consequence of vaccination is by no means rare; and the proportion of persons subjected to vaccination dying as a direct consequence thereof is about 14 times greater than the

number dying from chicken-pox, and 1.7 times greater than the number dying from small-pox itself under the average conditions existing between 1876 and 1910. For the interpretation of this result reference should be made to the evidence of other tables. The actual number dying are shewn on Table VIII.: 30,349 died of small-pox, 3800 of chicken-pox, and 1309 as a consequence of vaccination, in 35 years.

The extent of vaccination in Germany and Japan, which are probably the most thoroughly vaccinated countries in the world, is deducible from the figures given in the following tables:—

STATISTICS OF VACCINATION.

TABLE X.

GERMANY (FOR THE FIVE YEARS 1900 TO 1904 INCLUSIVE).

	Number of Persons due for Vaccination.	Number Successful.	Per- centage Successful	Percent- age not Successful or Results Unknown.	Not Vaccinated.	
					Per- mitted.	Contrary to Law.
First vaccination..	8,890,345	7,540,800	84.82	2.70	10.38	2.10
Revaccination ..	6,444,996	5,879,200	91.22	6.21	2.13	0.44
Total ..	15,335,341	13,420,000	87.51	4.18	6.91	1.40
Average per annum	3,067,068	2,684,000	..	..	..	..

Average population, 1900 to 1904, 57,724,500

TABLE XI.

JAPAN (FOR THE FIFTEEN YEARS 1895 TO 1909 INCLUSIVE).

	Total Number of Vaccinations.	Number Successful.	Percentage Successful.
First vaccination	22,807,919	19,241,153	84.36
Revaccination	37,940,845	12,904,901	34.01
Extraordinary vaccination	24,368,230	8,063,603	33.09
Total vaccinations	85,116,994	40,209,657	47.24
Average per annum	5,674,466	2,680,684	..

Average population, 1895 to 1909, 46,067,600.

TABLE XII.

Mortality from Small-pox in various Countries. Average for years 1862-1876 1882-1896, 1896-1910.

The number of deaths per 100,000 inhabitants were:—

Period.	Prussia and Bavaria.	Austria.	Belgium.	England.	Sweden.	Japan.
1862-1876	51.6	75.2	79.5	25.3	26.9	..
1882-1896	0.7	38.6	18.2	2.9	0.5	..
1896-1910	..	..	..	..	..	3.31

The relatively insignificant place which Small-pox takes compared with other common diseases, such as measles and scarlet fever is shewn by Table XV.



DEATH THROUGH VACCINATION.

Complete Australian statistics of death due to vaccination are not available, but it may be mentioned that in Victoria, in the 21 years 1880 to 1900 inclusive, there were 5 deaths from small-pox and 14 deaths from the effects of vaccination. The English results of 49.4 deaths directly attributable to 1,000,000 cases of vaccination furnish only the cases where death is a *direct* consequence, whereas, in order to properly estimate the tribute to death which has to be paid for vaccination, what is required is the *number of deaths that would not have occurred but for the fact of vaccination*. Such a number is the proper number for comparison with the number of deaths attributable to small-pox in an unvaccinated community, or with some modification with a partially or completely vaccinated community.

Table XIII. furnishes the number of deaths from small-pox per million for different periods, and Table XIV. the number of deaths that, according to English experience, would be *directly* referable to vaccination, with the death-rate 49.4 per million cases of vaccination, if it were enforced at the ages 6 months, 5½ years, 10½ years, 15½ years, and 20½ years.

TABLE XIII.

ANNUAL DEATHS IN ENGLAND AND WALES FROM SMALL-POX PER 1,000,000 PERSONS, 1851 to 1910.

1851	396	1861	66	1871	1,024	1881	119	1891	2	1901	10
1852	409	1862	81	1872	833	1882	50	1892	15	1902	75
1853*	174	1863	293	1873	102	1883	36	1893	49	1903	23
1854	153	1864	373	1874	92	1884	82	1894	27	1904	15
1855	136	1865	309	1875	40	1885	103	1895	7	1905	4
1856	121	1866	144	1876	99	1886	11	1896	17	1906	1
1857	206	1867	118	1877	173	1887	19	1897	†	1907	†
1858	335	1868	96	1878	74	1888	37	1898	8	1908	†
1859	197	1869	72	1879	21	1889	1	1899	5	1909	†
1860	140	1870	118	1880	25	1890	†	1900	3	1910	†

* First year of compulsory vaccination. † Less than 0.5 per million.

INCREASE OF DEATHS BY VACCINATION.

TABLE XIV.

Assuming that vaccination was compulsory at the ages of 6 months, 5½ years, 10½ years, 15½ years and 20½ years, the number of deaths *immediately* attributable to the effects of vaccination would, on the basis of the English experience for the years 1894–1906, be as follows:—

AGE.	England and Wales 1910.		C'wealth. of Australia 1912.	
	Approx. No. who attained each age in 1912.	Estimated No. of deaths from effects of vaccination.	Approx. No. who attained each age in 1912.	Estimated No. of deaths from effects of vaccination.
6 months	..	836,405	42	120,269
5½ years	..	715,394	36	92,296
10½ "	..	694,663	35	88,687
15½ "	..	669,785	33	90,801
20½ "	..	636,415	32	91,025
Total	..	3,552,662	178	483,078
Mean Population	..	35,796,289		4,644,852
Death rate per 1,000,000 of mean population from vaccination effects on above assumption..	..	5.0*		5.2*

* The number of deaths properly attributable is larger than this for reasons above indicated.

TABLE

DEATHS, IN VARIOUS COUNTRIES, FROM SMALLPOX.

No.	Country.		1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
1	Commonwealth of Australia ..	Small-pox ..	2	25	..	5	4	..	25	2	..	..	7	2
		Measles ..	192	68	155	519	111	31	131	252	33	..	14	4
		Scarlet Fever	175	162	129	292	148	122	88	149	106	200	99	102
2	United Kingdom	Small-pox ..	3,189	1,449	984	2,249	2,870	301	537	1,032	31	16	56	442
		Measles ..	8,714	15,518	11,759	13,323	17,244	12,978	19,670	13,125	17,254	15,849	14,688	17,016
		Scarlet Fever	17,192	16,545	15,750	13,506	8,446	7,894	10,011	7,959	7,856	8,032	6,003	6,908
3	New Zealand ..	Small-pox ..	..	..	..	..	..	..	..	..	..	..	..	..
		Measles ..	113	86	15	31	1	54	30	6	3	1	1	..
		Scarlet Fever	104	153	26	17	12	7	18	21	19	31	24	4
4	Canada (Ontario) ..	Small-pox ..	5	15	4	63	30	19	..	..	..	..	..	..
		Measles ..	148	75	177	81	78	149	169	128	141	186	79	117
		Scarlet Fever	470	543	405	382	314	260	116	132	159	151	216	240
5	Ceylon ..	Small-pox ..	237	320	335	347	726	462	89	145	97	88	452	69
		Measles ..	610	78	5	41	50	166	170	184	235	287	574	390
		Scarlet Fever	..	..	..	..	..	..	..	..	..	..	..	..
6	Norway, Sweden, and Denmark	Small-pox ..	318	223	129	61	33	2	6	14	8	4	26	7
		Measles ..	1,441	2,902	1,280	675	727	494	1,290	2,255	821	1,125	2,173	1,011
		Scarlet Fever	3,117	2,749	3,600	3,851	4,511	4,302	2,931	1,961	1,778	3,031	2,041	1,870
7	Finland	Small-pox ..	8,057	4,137	784	321	279	266	180	99	130	90	105	790
		Measles ..	..	..	..	..	..	..	..	..	..	..	..	..
		Scarlet Fev.)	2,336	1,412	3,642	4,179	5,256	5,696	1,767	1,048	1,425	2,933	5,702	7,576
8	German Empire (99 per cent.)	Small-pox (1)	*	*	*	*	*	*	*	*	*	*	*	105
		Measles ..	*	*	*	*	*	*	*	*	*	*	*	14614
		Scarlet Fever	*	*	*	*	*	*	*	*	*	*	*	10437
9	Austria ..	Small-pox ..	18019	21154	13310	11521	13212	8,794	9,591	14138	12358	5,935	6,838	6,087
		Measles ..	10812	9,573	9,903	11953	11479	14209	14073	12627	8,990	15182	11816	8,941
		Scarlet Fever	14608	16906	13340	12503	12410	12147	15737	14571	10453	12158	13749	13790
10	Netherlands ..	Small-pox ..	75	153	673	62	31	72	18	1	10	1	10	49
		Measles ..	874	784	1,012	2,193	657	2,035	1,541	1,655	1,620	1,526	1,331	1,200
		Scarlet Fever	400	275	259	1,017	1,286	844	428	188	98	77	74	246
11	Belgium	Small-pox ..	2,721	1,570	1,796	1,355	1,636	1,213	610	865	1,212	636	1,300	2,528
		Measles ..	2,936	3,048	2,944	2,622	3,253	2,653	3,233	2,936	4,336	4,187	4,196	4,319
		Scarlet Fever	1,895	1,712	1,381	1,476	1,383	1,211	1,082	964	859	1,064	954	871
12	France (2)	Small-pox ..	*	*	*	*	*	*	*	*	*	2,136	1,537	1,897
		Measles ..	*	*	*	*	*	*	*	*	*	3,894	7,196	3,813
		Scarlet Fever	*	*	*	*	*	*	*	*	*	695	731	713
13	Switzerland ..	Small-pox ..	167	22	24	64	426	182	14	17	3	32	26	35
		Measles ..	537	250	220	157	390	341	451	249	470	481	594	316
		Scarlet Fever	278	316	243	247	150	99	163	270	429	400	533	211
14	Italy ..	Small-pox ..	*	*	*	*	*	*	16249	18110	13416	7,017	2,910	1,453
		Measles ..	*	*	*	*	*	*	23768	20961	13800	14396	19551	12399
		Scarlet Fever	*	*	*	*	*	*	14631	9,050	6,444	7,344	7,294	7,890
15	Japan ..	Small-pox (3)	453	197	295	410	3,299	18676	9,967	853	328	25	721	8,409
		Measles ..	*	*	*	*	*	*	*	*	*	*	*	*
		Scarlet Fever	*	*	*	*	*	*	*	*	*	*	*	*
16	United States .. (Registration Area equals 60 per cent.)	Small-pox ..	*	*	*	*	*	*	*	*	*	*	*	*
		Measles ..	*	*	*	*	*	*	*	*	*	*	*	*
		Scarlet Fever	*	*	*	*	*	*	*	*	*	*	*	*

* Information not available. (..) Indicates no deaths. (1) Including deaths from Rubella.
 (3) Figures for whole of Japan for 1896 onwards from the Statistical

XV

MEASLES, AND SCARLET FEVER COMPARED.

1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	No.
7 1,280 210	3 335 214	.. 6 103	.. 8 99	11 180	2 1,452 234	1 404 131	.. 132 41	5 138 24	1 416 104	19 89 193	28 133 100	.. 41 44	.. 147 61	.. 125 37	125 63	31 74	1 124 48	1
1,526 15831 8,271	1,021 13763 6,465	416 13855 5,904	547 19649 6,897	38 15837 5,815	255 15826 4,782	176 13129 4,758	139 15175 4,743	636 11133 5,139	2,545 15394 5,585	841 10969 4,775	708 14340 4,251	125 13547 4,215	22 11277 3,854	12 14362 3,552	18 11372 3,280	21 13951 3,899	* * *	2
525 1	14 5	.. 6	1 4	1 2	57 2	137 ..	9 10	7 17	134 39	143 131	10 13	8 10	12 18	101 25	19 60	26 26	1 13	3
* *	* 454	* *	.. 136 99	80 169	115 222	7 246	11 143	7 181	21 143	3 55	3 30	3 63	4 128	4 166	2 163	3 167	3 204	4
37 254 ..	3 188 ..	5 372 ..	21 384 ..	25 566 ..	13 292 ..	96 188 ..	41 123 ..	80 207 ..	35 194 ..	6 158 ..	2 64 ..	112 211 ..	72 296 ..	27 89 ..	303 102 ..	82 232 ..	29 57 ..	5
26 364 1,984	23 992 1,706	3 824 1,157	3 1,036 933	4 1,026 608	7 630 52	1 1,142 77	2 731 83	6 741 49	1 1,076 103	2 1,188 72	2 509 36	2 413 18	9 371 29	.. 723 23	1 886 24	20 464 61	5 528 70	6
876 3,890	255 3,287	72 1,479	56 1,692	62 1,797	77 2,414	83 5,126	49 6,282	103 4,900	72 3,283	35 2,632	36 1,398	18 1,222	29 2,258	23 3,251	24 2,773	61 2,043	70 1,900	7
151 13555 13575	84 16130 8,884	27 9,536 8,538	10 13462 8,142	5 10793 6,720	16 12728 9,031	25 12794 13369	49 12317 13169	52 16341 13351	12 14085 12949	18 14979 14851	25 12389 12651	27 9,421 9,351	47 13340 9,974	63 11330 11151	65 10612 10852	23 10269 11082	* * *	8
5,821 7,503 12695	2,512 14228 12287	1,161 8,577 13547	897 7,928 16341	1,450 9,229 14316	2,521 13765 15009	1,899 11556 14614	369 5,731 10422	96 8,166 12551	30 17169 14930	17 5,546 15573	17 8,260 9,767	20 6,789 8,099	39 9,107 10554	41 6,805 10006	14 7,923 14965	13 12392 16123	5 10079 13765	9
190 795 233	625 737 128	79 538 166	34 1,171 202	1 538 162	7 838 106	6 405 206	6 1,326 152	7 2,741 101	5 2,430 128	22 1,223 132	11 2,399 175	13 1,182 191	6 1,400 155	6 1,477 269	1 1,576 302	968 1,176 177	1 1,176 113	10
2,103 4,137 847	537 2,766 816	298 3,535 1,159	130 3,134 1,003	140 2,083 1,019	158 2,364 1,726	257 3,188 2,095	193 2,610 1,360	260 2,036 1,409	652 3,305 992	1,630 2,309 698	656 2,758 726	244 2,446 760	41 2,459 785	55 2,011 927	42 2,982 1,203	40 2,676 1,184	* * *	11
1,336 4,662 801	1,155 3,056 647	1,082 2,095 675	1,076 3,290 744	190 2,831 412	105 2,828 541	670 3,046 796	1,783 2,521 574	1,017 1,937 550	2,553 2,317 511	2,350 2,163 496	735 2,055 410	292 1,783 308	631 3,754 907	2,679 3,763 1,623	171 3,222 1,495	87 2,881 1,557	* * *	12
15 870 138	51 473 58	1 185 62	8 423 89	1 272 47	2 354 34	3 264 38	30 809 34	37 829 71	2 456 73	2 545 162	4 821 279	36 657 312	14 569 153	8 613 140	2 226 147	3 373 170	* * *	13
2,638 12953 6,596	2,606 9,001 4,511	2,998 11322 3,814	2,033 11499 3,234	1,003 6,156 3,907	420 5,429 4,492	214 7,433 4,483	316 8,827 1,483	3,396 5,562 1,185	2,413 9,961 1,338	6,049 7,283 1,991	3,093 5,332 1,611	482 6,738 1,689	169 9,726 2,724	451 8,184 2,940	559 11740 3,464	758 11043 2,703	* * ..	14
11852 * *	3,342 * *	268 * *	3,388 * *	12276 * 3	362 * 7	232 2,558	7 1,740	7 3,643	24 3,348	25 850	154 1,434	70 4,129	99 2,351	211 2,107	4,274 2,742	36 4,504	* * *	15
* * *	* * *	* * *	* * *	* * *	* * *	* * *	611 3,865	1,085 2,287	2,111 3,033	1,382 3,221	709 3,659	308 2,557	95 5,087	74 4,302	92 4,611	79 4,860	202 6,598	16
* * *	* * *	* * *	* * *	* * *	* * *	* * *	3,135 4,113	4,041 3,991	3,610 2,284	3,227 4,309	5,577 5,781	6,255						

(2) Prior to 1906 the figures relate to Towns only with a population over 5000 persons.
 Summary of Japan (published at Tokyo) are given on Table VII.

COMPULSORY VACCINATION OF CHILDREN.

Compulsory Vaccination Acts exist in all States of the Commonwealth except New South Wales. Except in Victoria these Acts are, however, not generally enforced. (See Official Year Book of the Commonwealth, No. 6, p. 1097).

The years in which vaccination for children became compulsory in the Australian States and in some of the countries of Europe and Japan are as follows:—South Australia, 1853; Victoria, 1865; Western Australia, 1878; Tasmania, 1882; Queensland, 1900; Bavaria, 1807; Denmark, 1810; Sweden, 1814; Würtemberg, Hesse, and some other German States, 1818; Prussia, 1835; United Kingdom, 1853; German Empire, 1874; Roumania, 1874; Hungary, 1876; Servia, 1881; Austria, 1886; Japan, 1876.

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GENERAL RESULTS.

The general deductions from the statistical results are as follow :—

1. In England the death rates amongst unvaccinated persons actually attacked are about $3\frac{3}{4}$ times as great as among the vaccinated attacked.
2. There were $3\frac{3}{4}$ times as many vaccinated persons attacked in England as unvaccinated, but this may be due to the larger numbers of vaccinated persons in the community.
3. Isolation has probably more effect than vaccination in preventing epidemics. (Compare results for Europe and Japan, and the experience of Australia.)
4. Epidemics may occur in spite of vaccination and re-vaccination, possibly due to insufficient care as to isolation. (Compare results for England, Japan, and Australia).
5. According to the English results the proportion of deaths from vaccination to the total number vaccinated is at least 14 times as great as the proportion of deaths from chicken-pox to the entire population. This risk, however, is not annually repeated.
6. Between the years 1894 and 1906 inclusive, in the then state of vaccination of the community, and with the degree of isolation secured, the frequency of death directly attributed to vaccination (i.e., number of deaths to number vaccinated) was 3.3 times the frequency of deaths from small-pox (i.e., number of deaths to the total population). These results are for England.
7. The frequency of death properly attributable to vaccination in England is not accurately known, but is no doubt higher than 50 per million cases of vaccination.
8. Compulsory vaccination every five years up to the 21st year would, on the basis of English experience, result in Australia in not less than 24 deaths annually from the effects of the vaccination itself.
9. There were only 108 deaths from small-pox in Australia between 1881 and 1910. Deaths from vaccination according to English experience would number 150 with only one vaccination in each lifetime.
10. The attack rate for small-pox appears to be greater amongst unvaccinated than amongst vaccinated persons. This appears also to vary with age, being, according to English experience, 7.5 times as great for persons under 10, and less than 1.8 times as great for persons over 10 (See Table III.).
11. Japanese experience appears to shew that repeated vaccination does not ensure immunity from attack.
12. Thirteen years experience of vaccination in England and Wales, 1894 to 1906, shews that the risk of death following directly from vaccination is no less than one in 20,000—that is for every 20,000 persons subjected to vaccination, one person will probably die as a *direct* consequence.

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